



# Forest Health *highlights*

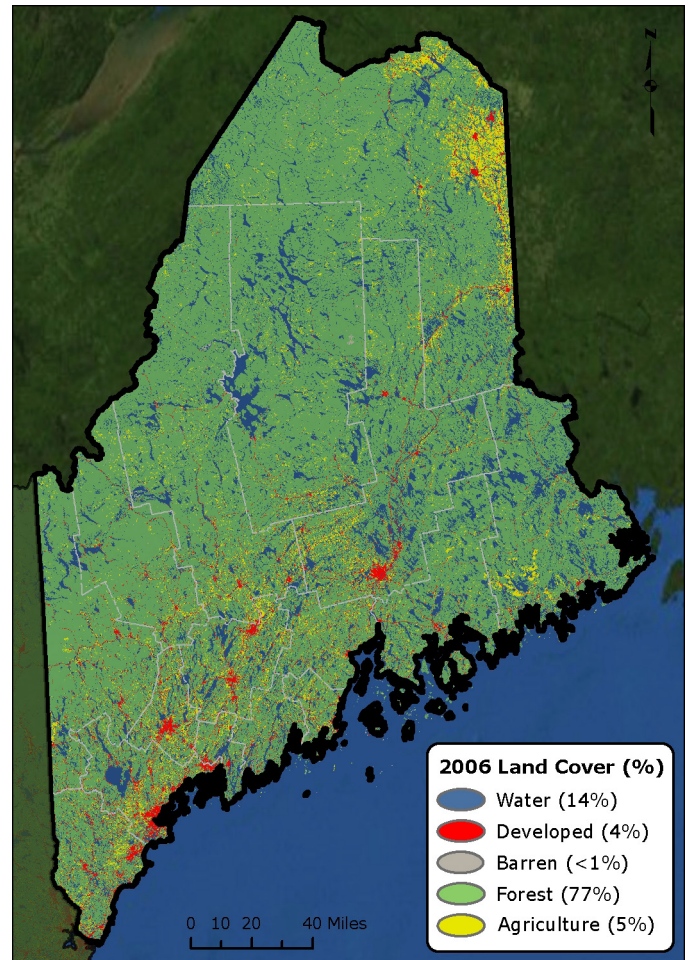
MAINE



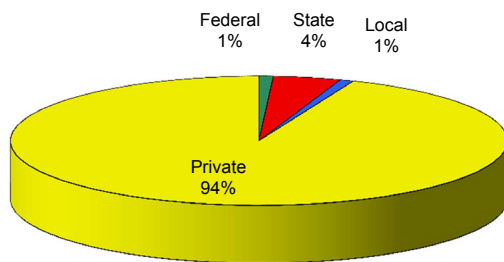
## Forest Resource Summary

Almost all—approximately 94 percent—of the forest lands in Maine are privately owned. The 1 percent that is federally owned encompasses the eastern portion of the White Mountain National Forest, most of which is in New Hampshire. The latest Maine forest inventory estimated that there are approximately 17.7 million forested acres in the State. The forest resource is made up of a variety of forest types, mostly spruce and balsam fir, maples, other hardwoods, and pine.

Maine's forests provide much of the raw materials to fuel the State's mills and serve as the backdrop for the recreation industry. These forest-based industries employ more than 12 percent of Maine's workforce and generate more than 11 percent of the State's payroll. The overall annual contribution of the forest resource to Maine's economy



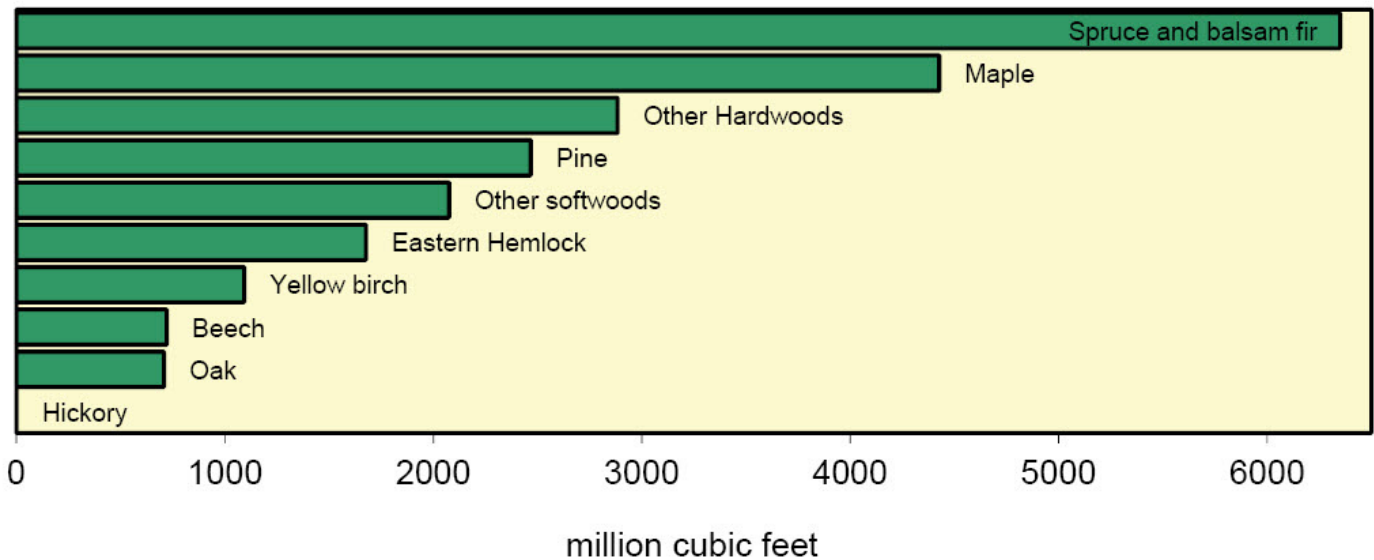
Forest Land Ownership in Maine, 2007



## Forest Health Programs in the Northeast

State forestry agencies work in partnership with the U.S. Forest Service to monitor forest conditions and trends in their State and respond to pest outbreaks to protect the forest resource.

Forest Species by Volume in Maine, 2007



exceeds \$8.5 billion. The State's forests also provide watershed, environmental, wildlife, and recreational benefits. Forested parks and individual shade trees provide similar amenities in urban and suburban settings.

## Aerial Surveys

Aerial detection surveys were flown over nearly 18 million acres in Maine. Less than 18,000 acres of forest damage were mapped, and they were mostly defoliation from winter moth in the southeastern coastal area of the State. Some defoliation was also mapped: less than 1,000 acres each from browntail moth and fall cankerworm, and less than 100 acres from gypsy moth. The bare-patched oak leafroller—a rarely reported insect that caused significant damage in 2012—declined in 2013, and moderate defoliation was mapped on a little over 400 acres. Hail and frost contributed to a small amount of forest damage, and needlecast disease caused discoloration of about 1,200 acres of pine.

*Aerial detection survey (ADS) results for Maine in 2012 and 2013.*





## Diseases

**Hemlock shoot blight** (*Sirococcus tsugae*) is prevalent throughout the State wherever hemlocks are found. During 2012, 24 plots in Maine were surveyed for hemlock shoot blight (2 at the Massabesic Experimental Forest and 22 Forest Inventory and Analysis plots). In 2013, data analysis has shown that hemlocks in only 3 plot locations in Maine had no symptoms; 19 plots had trees with up to 10% of shoots affected, and 2 plots had trees with up to 25% of shoots infected. The disease is thought to have its most significant impact on hemlock regeneration, although trees of all sizes and ages are susceptible to damage.

**Hardwood leaf damage** caused by many anthracnose and leaf spots pathogens was prevalent throughout the 2013 growing season. A long period of wet spring weather continued from late May through June, resulting in significantly high infection levels in many tree species. Most seriously affected were the oaks. The effects of the anthracnose on oaks were magnified by previous leaf damage resulting from late spring frosts that occurred from May 12 through May 14. All oak species were affected, but damage to red oaks was most noticeable.

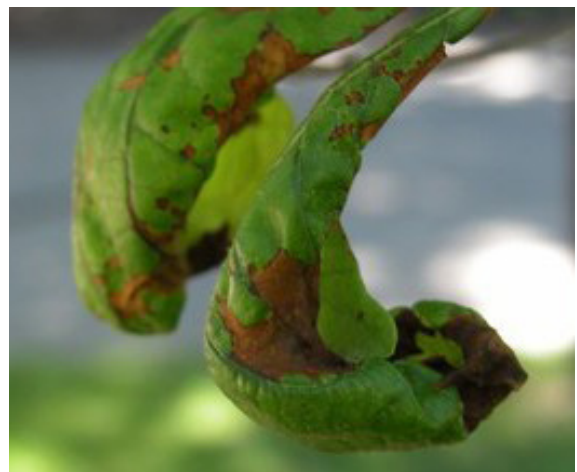
Observations revealed a wide range of individual tree response to the combination of damage from frost and anthracnose. Oaks with more than two-thirds of their crown damaged could often be found adjacent to individuals showing only a trace of damage. Occurrences of both frost damage and anthracnose on the same individual often complicated the diagnoses. The primary pathogen identified was *Apiognomonia quercina*.



*Hemlock shoot blight causes mortality of buds and shoots.*



*Oak anthracnose on red oak: whole-crown view.*



*Oak anthracnose on red oak: closeup of leaf.*

Specific reports of oak damage were recorded from the following towns, listed by county:

Androscoggin County—Sabattus  
Cumberland County—Brunswick, Cape Elizabeth, Cumberland, Naples, and Windham  
Franklin County—Chesterville  
Hancock County—Bar Harbor, Brooksville, Deer Isle, Hancock, and Somesville  
Kennebec County—Albion, Augusta, Chelsea, China, Litchfield, Windsor, and Winthrop  
Knox County—Cushing, Hope, and Rockport  
Lincoln County—Boothbay, Bremen, Damariscotta, Jefferson, and Whitefield  
Penobscot County—Hampden and Orono  
Piscataquis County—Greenville  
Sagadahoc County—Topsham  
Waldo County—Lincolnville, Northport, and Stockton Springs  
Washington County—Grand Lake Stream  
York County—Kennebunk

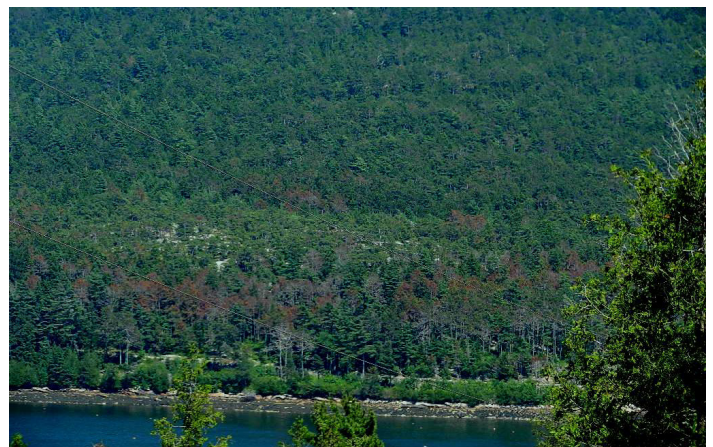
*Sirococcus* **shoot blight** (*Sirococcus conigenus*) is now regarded as the single most serious threat to red pine in natural stands and in plantations in Maine. As a result of nearly a decade of consecutive spring and early summer seasons of above-average precipitation, the disease is causing significant mortality in reproduction, immature, and mature stands in several regions of the State.



Red pine mortality from *Sirococcus conigenus* and *Diplodia tip* blight, Northeast Harbor, ME.

This year, heavy mortality of large, mature red pines occurred in natural stands in Acadia National Park and in neighboring towns on Mount Desert Island. *Diplodia pinea*, another shoot blight pathogen, is often found along with *S. conigenus*. Significant damage has also been recorded previously from plantations in Hancock and Washington Counties, and in central Maine (Somerset County).

The **white pine needle cast and needle blight** disease complex is increasingly becoming a threat to the white pine resource throughout the Northeastern United States. Primary causal agents identified include *Mycosphaerella dearnessii* (= *Lecanosticta acicola*), *Lophophacidium dooksii* (= *Canavirgella banfieldii*), and *Bifusella linearis*. Most at risk appear to be white pines that are mature or over-mature, and those growing on marginal sites, such as along shallow and rocky stream edges and shorelines, low wet sites, and in unmanaged and over-stocked stands. However, all affected pines—even those on good sites and with little crown competition—exhibit thin crowns, often with off-color foliage and a pronounced increased rate of shedding of the lower branches. The disease remains widespread but is most severe throughout central, western, and southern Maine.



*Sirococcus conigenus* infection resulted in red pine mortality, Somes Sound, Northeast Harbor, ME.





*White pine regeneration heavily affected by white pine needle disease, Bethel, ME.*



*White pine affected by white pine needle disease, Bethel, ME. One-year-old needles (2012) are browned and shed before current-season growth (2013) is fully developed.*

## Insects

**Winter moth** (*Operophtera brumata*) is firmly established along the coast of southern Maine from Kittery (York County) to Bar Harbor (Hancock County). The Maine Forest Service deployed a handful of pheromone traps in 2012 to confirm the presence of the moth in areas where a few male moths had been picked up in an early survey in 2005–2006. Then a news story in early December included a request for moths to be sent to the Maine Forest Service Entomology Lab. This resulted in the public submitting over 460 moths in more than 140 samples from Kittery to Bar Harbor. This citizen response allowed the Maine Forest Service to tentatively predict the potential for winter moth defoliation in Maine in 2013.



*Incredible public response to a request for moth samples allowed the Maine Forest Service to make preliminary predictions for winter moth defoliation in 2013.*

Defoliation was moderate to heavy in scattered locations along the coast from Cape Elizabeth (Cumberland County) to Bristol (Lincoln County) and fairly well matched the risk map developed from the submitted samples. The total area defoliated was 5,180 acres. Light defoliation was observed in many additional areas close to the coast in York, Cumberland, Sagadahoc, Lincoln, and Knox Counties. Male moths were positively confirmed by dissection in Hancock County, although no defoliation was found in 2013.



*Defoliation by winter moth was moderate to heavy in scattered locations along the coast, from Cape Elizabeth (Cumberland County) to Bristol (Lincoln County); 5,180 acres were defoliated.*

The parasitoid *Cyzenis albicans* was released in two locations in cooperation with Joe Elkinton, University of Massachusetts. One release site was in Harpswell and the second in Cape Elizabeth, where there was even more defoliation than in Harpswell. Additional releases are planned for the future with Vinalhaven high on the list of release sites. Concerned citizens from that island community were proactive in reaching out to their congressional delegation about the winter moth problem, potential control, and continuing the effort to bring this invasive insect into balance with the Maine environment.

The Maine Forest Service set up a series of long-term winter moth plots in Harpswell, Brunswick, and Topsham, which the U.S. Forest Service will be monitoring to assess the impact of winter moth on the forest. The plots were set up in areas with heavy defoliation, light defoliation, and no defoliation, so that the progression of the infestation can be followed.

University of Maine graduate student Kaitlyn O'Donnell is looking at a variety of issues involving winter moth. Her thesis project has these objectives:

- Study winter moth larval development and survival on seven different host plants: oak, red maple, birch, pin cherry, apple, and highbush and lowbush blueberry, in the lab and in the field
- Assess the risk winter moth poses to the lowbush blueberry crop in Maine
- Sample field-collected winter moth larvae for disease and identify any viruses found
- Monitor the population distribution and density of winter moth in the town of Harpswell, ME
- Describe the phenology of the winter moth population in southern Maine

The Maine Forest Service (MFS) surveyed for winter moth using pheromone traps in December to determine where winter moth populations were heaviest. Traps were deployed in 62 towns along the coast and along a transect inland from known infested areas. MFS is also looking at where the moths pupate using emergence traps. This project is being conducted in conjunction with the Harpswell Coastal Academy. The students will be monitoring the traps and collecting the data. The Maine Forest Service is also working with the academy to investigate correlations between weather and moth emergence.



In spring 2013, **emerald ash borer** (*Agrilus planipennis*) was discovered in New Hampshire, about 50 miles from Maine's border. This increased the urgency of Maine's multitiered emerald ash borer (EAB) detection efforts. Detection survey components include use of baited traps and trap trees, biosurveillance with a native wasp, and outreach to the public.

The Maine Forest Service coordinated the State's participation in the second national EAB survey with purple panel traps. A total of 867 traps were hung in ash trees throughout the State, including receiving yards and lumber mills where ash had been accepted from possible infested areas of Connecticut, New Hampshire, and Massachusetts in the past 4–6 years. All traps have been retrieved and were negative for EAB.



A Maine Forest Service technician prepares to deploy an emerald ash borer trap.

Eight volunteers from the Small Woodland Owners Association of Maine girdled ash trees on their properties to serve as trap trees for EAB in spring 2012. The trees were felled in early 2013, and the boles were peeled and examined for EAB galleries at two workshops

hosted by the Maine Forest Service. No sign of EAB was detected. In spring 2013, with the help of Maine Department of Agriculture Conservation and Forestry foresters, 23 ash trees were girdled, primarily in State, private, and Federal campgrounds. These will be felled and peeled in early 2014.



Trap tree program volunteers learned about emerald ash borer and helped process bole sections.

Biosurveillance using *Cerceris fumipennis* was carried out at 28 locations throughout Maine, including some new sites and sites that had not been monitored for 2–3 years. Fifty-three colonies were visited, but many were too small for effective biosurveillance. No EAB were found.

Damage from **hemlock woolly adelgid** (*Adelges tsugae*) continues to accumulate in south-coastal Maine. Hemlock decline, due at least in part to hemlock woolly adelgid (HWA) damage, is apparent in several coastal

communities, although not yet detectable by aerial survey. One additional town, Old Orchard Beach (York County), was found to have forest infestations of hemlock woolly adelgid in 2013. This brings the number of towns in Maine known to have forest infestations to 38. These towns stretch out along the southern third of the Maine coast, an area that is rich in hemlock and connected to an inland concentration of hemlock-dominated forest. Most detected infestations are in areas between U.S. Route 1 and the coast.

In an effort to slow down artificial spread of the insect, the State quarantine on HWA was updated in 2013. The quarantine area was expanded to include infested areas detected since the 2007 revision, as well as buffer towns not known to be infested in Maine. The list of regulated articles was revised to exclude roundwood and lumber with the result that the only regulated forestry products are those with top material. Live plants from infested areas are still regulated.

Efforts to establish biological control of HWA continue in Maine. In 2013, through a cooperative agreement with the USDA Animal and Plant Health Inspection Service—Plant Protection and Quarantine, 10,000 *Sasajiscymnus tsugae* **beetles** were received from the North Carolina Department of Agriculture rearing lab. Inoculative releases of these beetles were made at two sites—one in Cape Elizabeth (Cumberland County) and the other in Wiscasset (Lincoln County). In addition, private, State, and Federal funds allowed for purchase of 5,750 *S. tsugae* from Tree-Savers LLC for augmentative releases at three State parks: Ferry Beach (Saco, York County), Vaughan Woods (South Berwick, York County), and Wolfe Neck Woods (Freeport, Cumberland County).



*Hemlock woolly adelgid biocontrol release tree in Wiscasset, ME.*

**Spruce budworm** (*Choristoneura fumiferana*) catches in pheromone traps were up dramatically in 2013. Many locations showed a fourfold increase in trap catches. In 2012 the average catch per trap across all sites was 5.5, and in 2013 the average was 20.7 moths per trap. The highest counts are at two sites (T17 R12 WELS and T17 R14 WELS) in Aroostook County with just over 100 moths per trap at each site. These numbers are high enough to trigger survey for larval feeding in 2014. Out of a total of 60 sites, 7 more sites had catches of over 50 moths per trap, and an additional 10 sites had over 20 moths per trap. This compares with 3 years ago when the highest trap catch was 13 moths per trap.



Light traps are not as sensitive to spruce budworm as are pheromone traps, and there have been very few if any budworms caught in them for years. In 2013 two of the nine trap catches processed to date had budworm in them. These were Allagash with 11 moths and Ste. Pamphile (T15 R15 WELS) with 56 moths. The Ste. Pamphile catch probably would have been even higher but it is run on an intermittent basis dependent on operator availability. Interestingly, near the light trap is a pheromone trap site, which caught only 35.3 moths per trap (a total of 106 moths in three pheromone traps). There are still no reports of larval feeding.

The Maine Forest Service will continue to monitor this serious pest, work with landowners to prepare for an outbreak in the next 2–3 years, and stay in communication with our Canadian counterparts who are already dealing with a spruce budworm outbreak in Quebec that is spreading into New Brunswick.

## References

### Land Cover Map:

U.S. Geological Survey. 2011. 2006 National land cover dataset. Sioux Falls, SD.

### Forest Land Ownership, Forest Species by Volume:

U.S. Department of Agriculture, Forest Service. 2009. Forest resources of the United States, 2007. Gen. Tech. Rep. WO-78. Washington, DC. 336 p.

## Acknowledgments

All photos: Maine Forest Service.



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